Weather Note

TORNADOES ASSOCIATED WITH HURRICANE CARLA, 1961

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ABSTRACT

A composite chart of tornadoes associated with hurricane Carla during a 4-day period of tornadic activity shows that the tornadoes occurred in the right half of the storm system relative to the storm's direction of movement.

1. INTRODUCTION

The occurrence of tornadoes in association with hurricanes, as with hurricane Carla in 1961, is nothing new. Tornadoes associated with hurricanes have been reported as far back as August 14, 1773 [1]. The purpose of the present note is to present Carla's tornado occurrences in relation to the storm system.

2. LOCATION OF TORNADOES RELATIVE TO STORM SYSTEM

In figure 1 are shown the locations of the tornadoes that occurred in the 4-day period September 10–13, 1961, in relation to the center and to the wind field of hurricane Carla. There were 16 tornadoes in all. Five of the tornadoes occurred in Galveston and vicinity from 0230 to 0900 CST on September 12 [2].

An interesting feature is that all the tornadoes occurred in the right half of the hurricane with reference to the direction in which the hurricane was moving. Thirteen of the tornadoes occurred within the area of gale force winds; the remaining three outside this area. No tornadoes were reported within the area of hurricane force winds. These areas were determined from available reports.

The nearest to the storm center that the tornadoes occurred was 130 n. mi. There were two tornadoes this close to the center. They struck at Bogota and Fulbright, Tex., on September 12 at 1645 CST when the center was about 20 n. mi. south of Fort Worth. The tornado that occurred the farthest from the center was

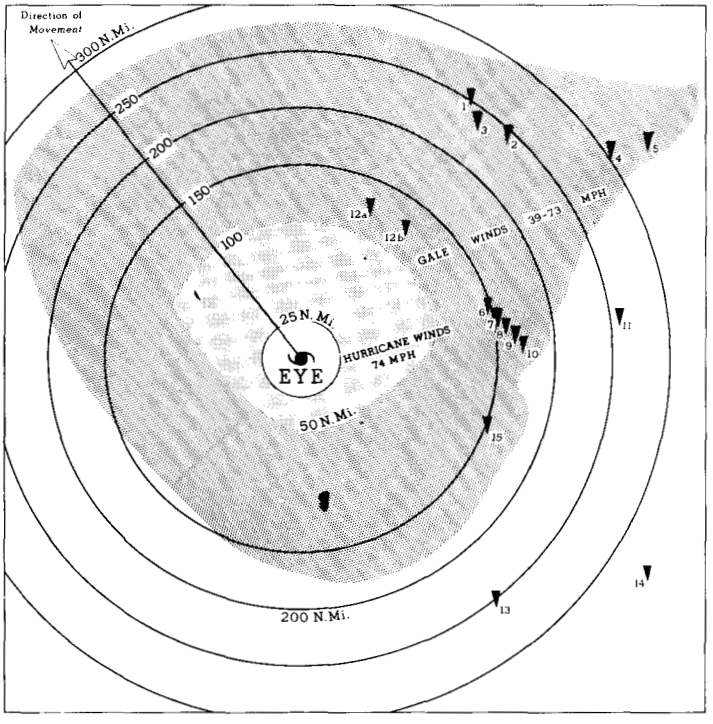

FIGURE 1. Tornadoes associated with hurricane Carla, September 10–13, 1961. Numbers correspond to list in table 1.

TABLE 1.—*Tornadoes associated with hurricane Carla. Numbers correspond to numbers beside symbols in figure 1*

No.	Date (Sept.)	Time (CST)	Place	Eye located	Tornado distance from eye (n. mi.)
1	10	1450	Kaplan, La.	130 n. mi. SE of Matagorda Peninsula.	240
2	10	1709	Lafayette, La.	110 n. mi. SE of Matagorda Peninsula.	250
3	10	1809	Gueydan, La.	100 n. mi. SE of Matagorda Peninsula.	225
4	10	2221	Patterson-Morgan City, La.	90 n. mi. SE of Matagorda Peninsula.	305
5	11	1110	18 mi. NNE of Baton Rouge, La.	30 n. mi. SE of Matagorda Island.	313
6	12	0230	LaMarque, Tex.	150 n. mi. S of Galveston.	150
7	12	0305	Galveston	Near Austin, Tex. 100 n. mi. inland.	155
8	12	0425	Galveston		160
9	12	0600	Galveston		
10	12	0900	Port Bolivar, Tex.		175
11	12	1300	Hodge, La.	Near Waco, Tex.	260
12a	12	1645	Bogota, Tex.	20 n. mi. S of Fort Worth.	130
12b	12	1645	Fulbright, Tex.	20 n. mi. S of Fort Worth.	130
13	13	0500	Latex, Tex.	Eastern Oklahoma.	250
14	13	0700	Near Hockley, Tex.	Eastern Oklahoma.	310
15	13	0830	Wilburton, Okla.	Eastern Oklahoma.	150

the one 18 n. mi. north-northeast of Baton Rouge, La., at 1110 CST on September 11. At that time the eye was located 30 n. mi. southeast of Matagorda Island, Tex., and the tornado was about 313 n. mi. to the northeast of the eye.

3. PATH OF HURRICANE WHILE TORNADOES WERE OCCURRING

When the first tornado occurred, which was at Kaplan, La., at 1450 CST on September 10, the eye of hurricane Carla was located 130 n. mi. off the coast of Matagorda Peninsula as shown in figure 2. Four more tornadoes

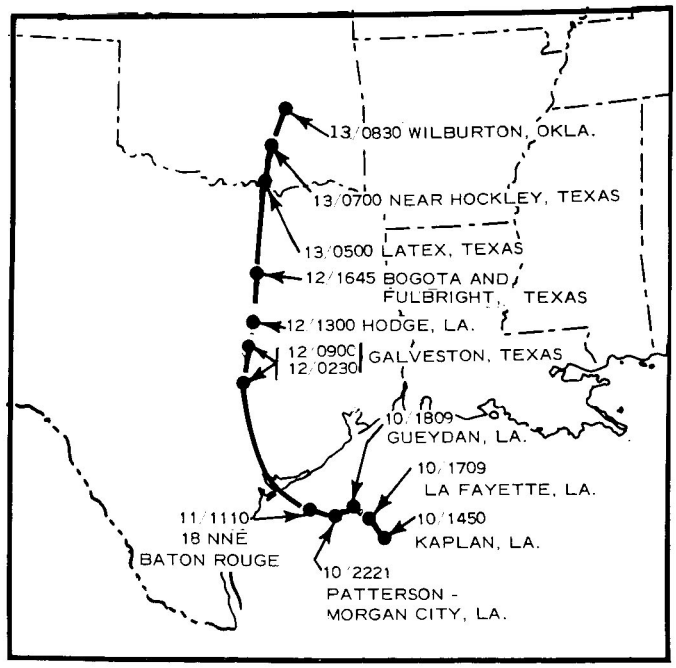

FIGURE 2.—Portion of track of hurricane Carla while tornadoes were occurring, September 10–13, 1961. Solid circles on track indicate locations of storm center at time of tornado for which date, time, and location are given.

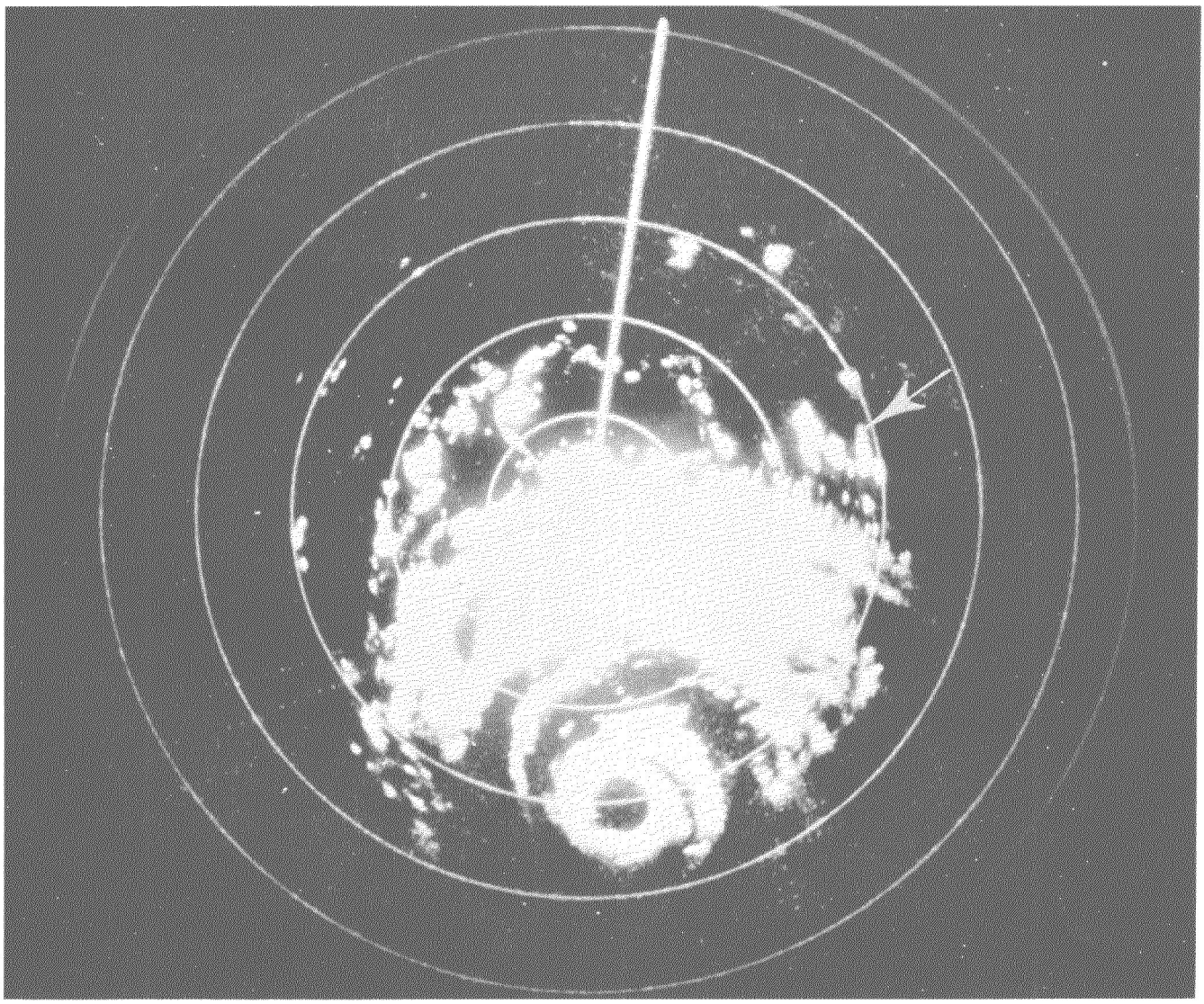

FIGURE 3.—Hurricane Carla as seen by WSR–57 radar at WBO, Galveston, Tex., September 10, 1961, 1450 CST, when tornado (location marked with arrow) occurred at Kaplan, La. (Distance between range circles in 50 n. mi.).

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occurred before the center of the hurricane moved inland. The remaining 11 were reported as the center of the then weakening storm progressed northward across Texas into southeastern Oklahoma, with the last, at Wilburton, Okla. at 0830 CST on September 13, occurring as Carla changed into the extratropical stage.

4. TORNADOES IN GALVESTON AND VICINITY

Five tornadoes occurred in Galveston and vicinity between 0230 and 0900 CST on September 12 [2]. Their direction of movement was northward. The lengths of their paths varied from 0.3 n. mi. for the tornado at Port Bolivar (which is across the channel to the north of Galveston) up to 5 n. mi. for the tornado at the eastern end of Galveston Island.

The times and locations of the five tornadoes were as follows: (a) 0230 CST at La Marque, (b) 0305 CST at Galveston Island, (c) 0425 CST at eastern end of Galveston Island, (d) 0600 CST at Galveston Island, and (e) 0900 CST at Port Bolivar.

5. RADAR PRESENTATION

The presentation of hurricane Carla on the radarscope of the WSR–57 radar at the Weather Bureau Office, Galveston, Tex., at the time of the occurrence of the first tornado associated with Carla is shown in figure 3. This tornado struck Kaplan, La., at 1450 CST on September 10. The location of the tornado, 140 n. mi., to the east-northeast of Galveston, is marked with an arrow. The echo associated with the tornado is apparently part of a short prehurricane squall line. The eye of hurricane Carla was located 150 n. mi. south of Galveston.

6. CONCLUDING REMARKS

Tannehill [3] stated that tornadoes were observed only in the northern semicircle of a hurricane. Dunn and Miller [4] referred to a study by Malkin and Galway [5] which showed that tornadoes in hurricanes had "been observed only in the forward semicircle or along the advancing periphery of the storm." In this case it was found that the tornadoes associated with hurricane Carla favored the right half of the hurricane relative to its direction of movement. More data are needed before one can safely conclude that tornadoes are not likely to occur in the left rear sector of hurricanes. Such confirmation of a tornado-free sector could prove useful in alerting the public to the possible occurrences of tornadoes when hurricanes threaten.

REFERENCES

1. A. M. Marshall, NHRP, Miami, Fla., Memorandum of July 7, 1960. (Official correspondence.)
2. E. R. Mahaffey, WBO, Galveston, Tex., Report on Tornadoes in Galveston and Vicinity, September 1961. (Official correspondence.)
3. I. R. Tannehill, *Hurricanes*, Princeton University Press, 1956, (pp. 24–25).
4. G. E. Dunn and B. I. Miller, *Atlantic Hurricanes*, Louisiana State University Press, 1960, 318 pp. (pp. 101–104).
5. W. Malkin and J. G. Galway, "Tornadoes Associated with Hurricanes," *Monthly Weather Review*, vol. 81, No. 9, Sept. 1953, pp. 299–303.